

Mashreq Water Data Portal Ecosystem

Nagaraja Rao Harshadeep (Harsh)

Global Lead (Disruptive Technology)

Environment, Natural Resources & Blue Economy Global Practice

Disruptive Technology



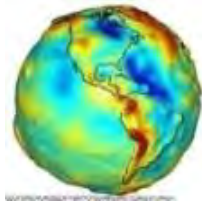
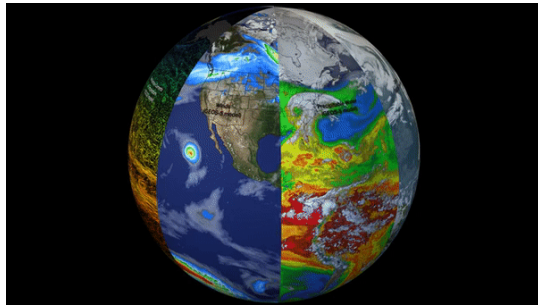
WORLD BANK GROUP

Disruptive KIDS (Knowledge, Information & Data Services) Helpdesk

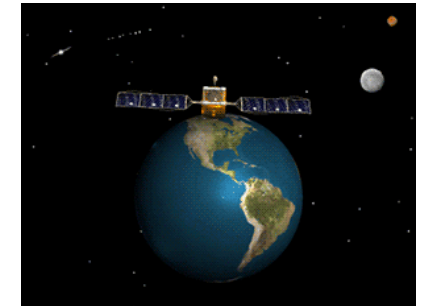
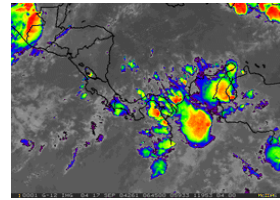
Mashreq Water Knowledge Series

Disruptive Technologies for Improved Groundwater Management in the Mashreq Region

15-17 June 2021



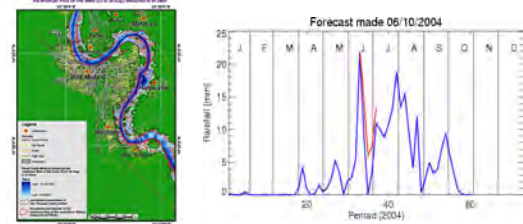
"Top-Down" Data Acquisition System



Satellite & Aerial Earth Observation

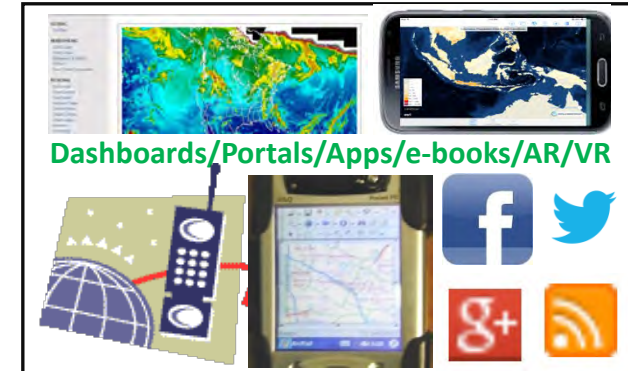
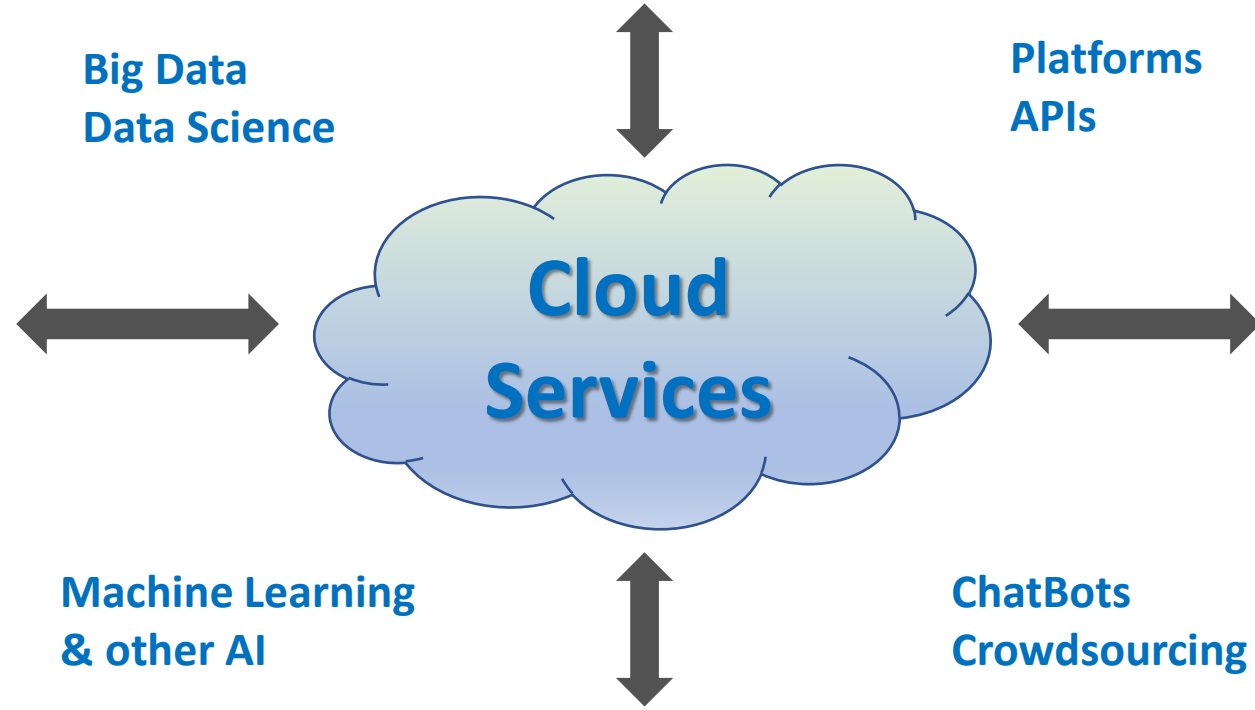


Data Rescue
GIS and other datasets



Data Management

Analytics/Models



Dashboards/Portals/Apps/e-books/AR/VR

Stakeholder Alerts



Operational Control Rooms



Manual Monitoring
Crowdsourcing



Automated Monitoring

"Bottom-up" Data Acquisition System → IoT



Mashreq Water Data Portal

<https://spatialagent.org/Mashreq> (also has links to [Knowledge Explorer](#) & [E-Book](#))

MASHREQ WATER RESOURCES PORTAL

All

Environmental

Social

Economic

Climate

Water

Disasters



Water Transition



Water Inventory



Windy



GEOGloWS Streamflow Explorer



Power Plants



GRDC



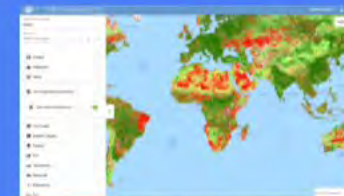
Watershed Delineation



NASA Disasters Portal



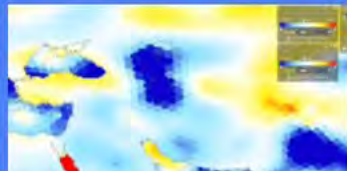
Earth Engine Water Watch



EarthMap (FAO)



Open Data Cube



GRACE Groundwater



Lake Levels

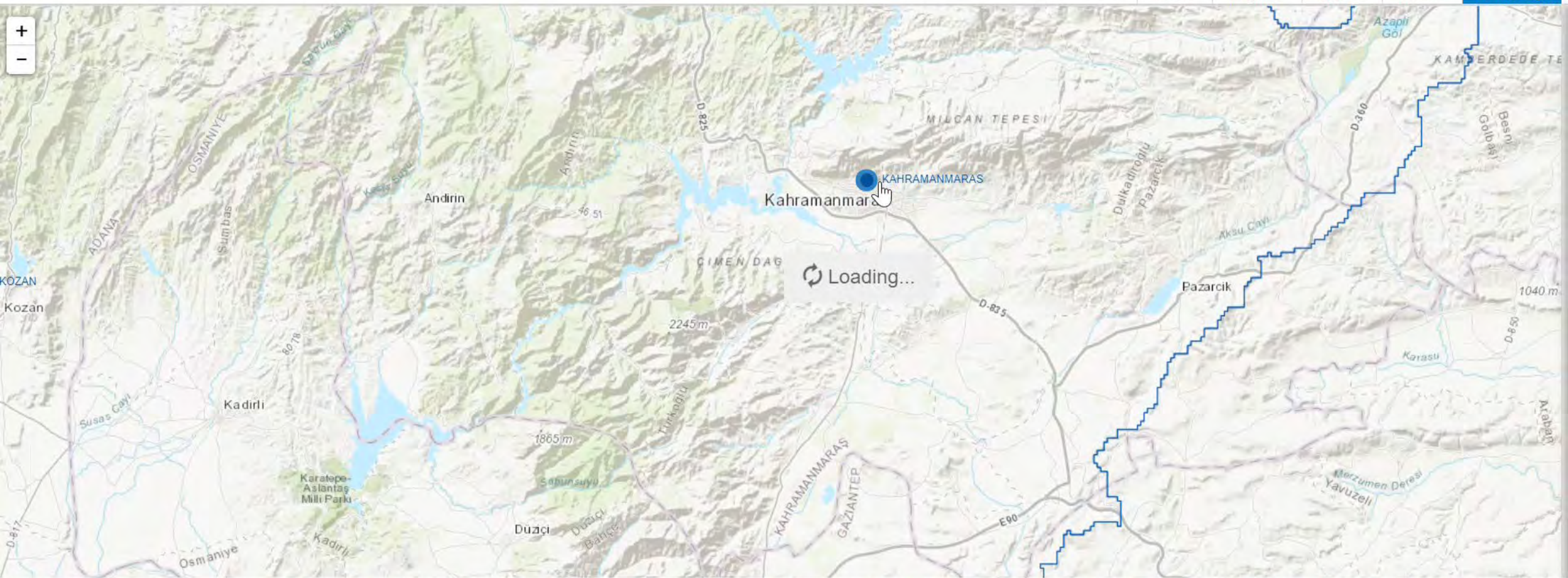


Climate Engine



MODIS Flood Explorer

Historical Climate



Recent Precipitation

Mashreq

x +

— □ ×

← → ↻ 🏠 ⚠ Not secure | spatialagent.org/Mashreq/satelliteprecip.html

🔍 ☆ ⚙️ N ⋮

Mashreq > Climate > NASA GPM/IMERG Precipitation Accumulation

Choose a country... ▾

☰

Image

- < 0.2 mm/hr
- 0.2-0.3 mm/hr
- 0.3-0.5 mm/hr
- 0.5-1.0 mm/hr
- 1.0-2.0 mm/hr
- 2.0-3.0 mm/hr
- 3.0-5.0 mm/hr
- 5.0-10.0 mm/hr
- 10.0-20.0 mm/hr
- 20.0-50.0 mm/hr
- 50.0-100.0 mm/hr
- > 100.0 mm/hr



- Esri Imagery
- Esri Topo
- National Geographic
- Esri Street Map
- Esri Dark Gray
- Esri Terrain
- NASA GPM/IMERG 30 Min Accumulation
- NASA GPM/IMERG 1-Day Precipitation Accumulation
- NASA GPM/IMERG 3-Day Precipitation Accumulation
- NASA GPM/IMERG 7-Day Precipitation Accumulation

Real-time Weather

Windy: Satellite

windy.com/-Satellite-satellite?satellite,31.813,41.982,5

Search location...



Login

Radar & Satellite

Weather radar

Satellite

Wind

Rain, thunder

Temperature

Clouds

Waves

Air quality

More layers...



11:11 PM - 1h 9m ago

Abri
BLUE VISIBLE INFRA+

12h 6h 2h

EUMETSAT

More layers...

°C -33 -43 -53 -63 -73

Climate Change



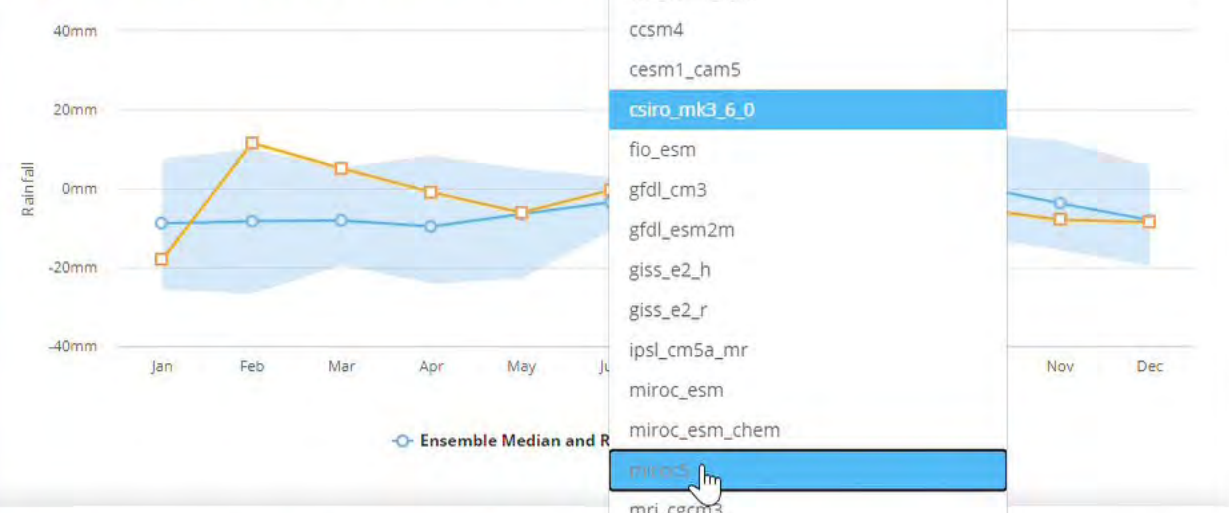
VARIABLE: Monthly Precipitation | TIME PERIOD: 2080-2099 | STATISTIC: Change (anomaly) | SCENARIO: RCP 8.5 (High emission) | MODEL: csiro_mk3_6_0

Projected Change in Monthly Precipitation of Watershed #21 for 2080-2099 (Compared to 1986-2005)

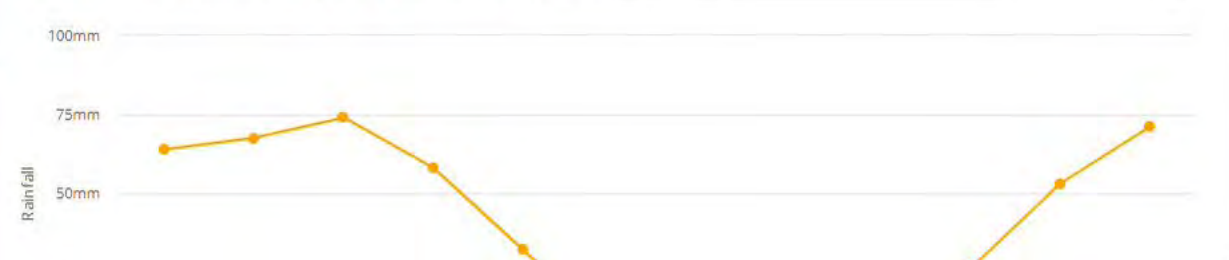


METADATA
Future climate information is derived from 25 available global circulation models (GCMs) used by the Intergovernmental Panel on Climate

Projected Change in Monthly Precipitation for Watershed #21 for 2080-2099 (Compared to 1986-2005)



Historical Observed Monthly Precipitation for Watershed #21



Lake, Reservoir & River Levels



[Click here to hide map / see product list below](#)



Select a basin, lake or river

● lake(s)
 ● virtual station(s)
 ● lake(s) and virtual station(s)

Records per page: 10

LAKE PRODUCTS						
<input type="checkbox"/>	Lake	Drainage basin	Country	Start date	End date	Type
<input type="checkbox"/>	Hulun	Amur	China	1992/10/15	2021/06/15	Operational
<input type="checkbox"/>	Chardarya	Aral-Drainage	Kazakhstan	1992/09/29	2021/06/15	Operational
<input type="checkbox"/>	Aydarkul	Aral-Drainage	Kazakhstan&Uzbekistan	1995/06/02	2021/06/15	Operational

Waterbody Area Dynamics (GEE)

Mashreq Data Portal

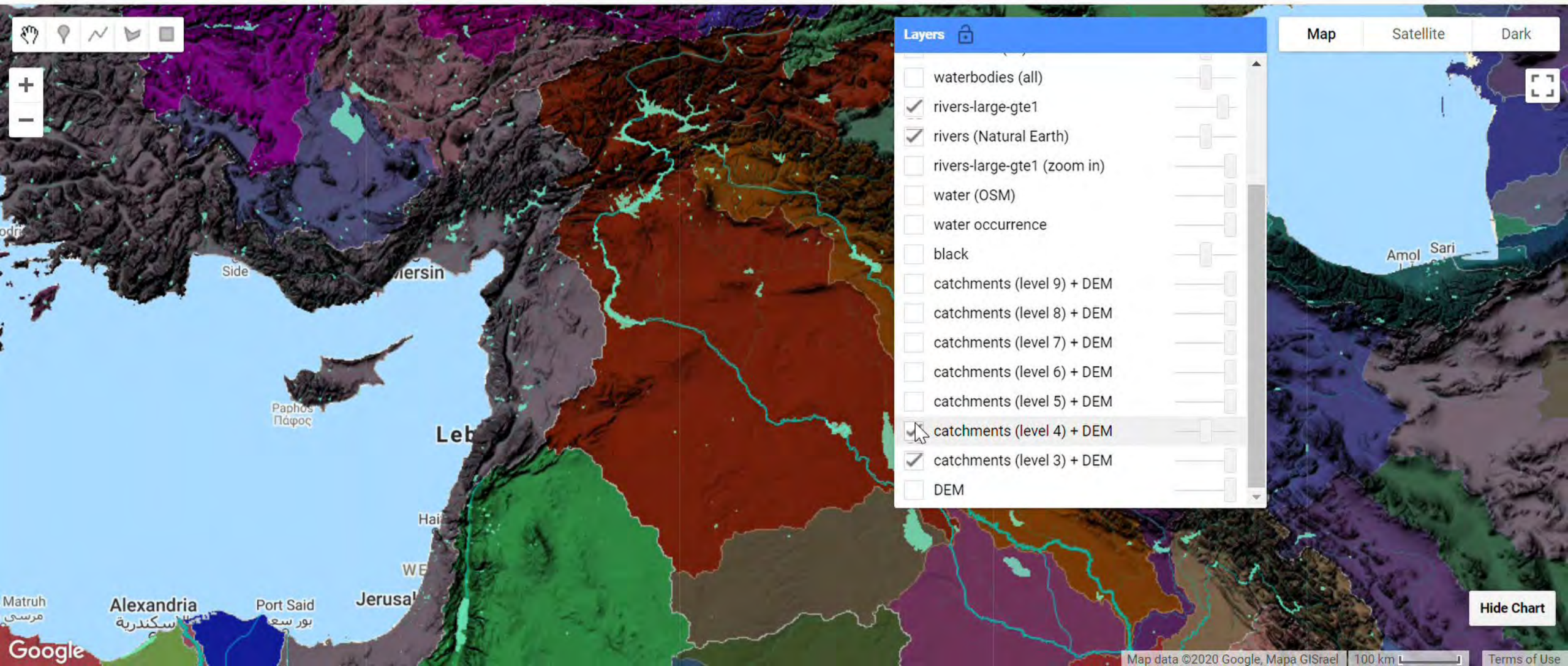
Water Watch

gena.users.earthengine.app/view/water-watch



Earth Engine Apps Experimental

Search places



- Layers
- waterbodies (all)
 - rivers-large-gte1
 - rivers (Natural Earth)
 - rivers-large-gte1 (zoom in)
 - water (OSM)
 - water occurrence
 - black
 - catchments (level 9) + DEM
 - catchments (level 8) + DEM
 - catchments (level 7) + DEM
 - catchments (level 6) + DEM
 - catchments (level 5) + DEM
 - catchments (level 4) + DEM
 - catchments (level 3) + DEM
 - DEM

Map | Satellite | Dark

Hide Chart

Streamflow Forecasts

GEOGloWS ECMWF Streamflow Hydroviewer

Map Controls

Map Animation

Fri Jun 18 2021 08:00:00 GMT-0400
(Eastern Daylight Time)

Find A Reach ID

Zoom to Lat/Lon Coordinates

Remove Map Marker

Switch to HydroShare Map

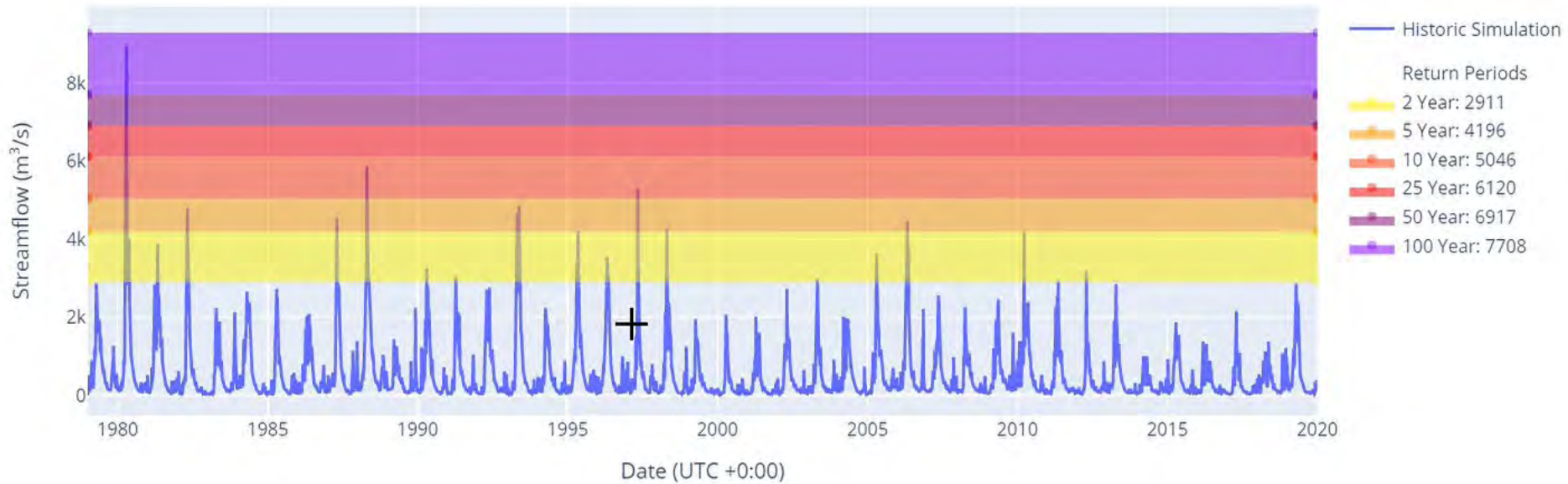
Stream Gauge Networks

Choose A Gauge Network



Historical Flows

Historic Streamflow Simulation
Reach ID: 606617



Return Periods for Stream 606617.0 (m³/s)

2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
2911.92	4196.01	5046.18	6120.38	6917.28	7708.3

Download Historical Data

Resize the Chart

Close



Transboundary Aquifers of the World map

Filter layers

Transboundary Aquifers of the World

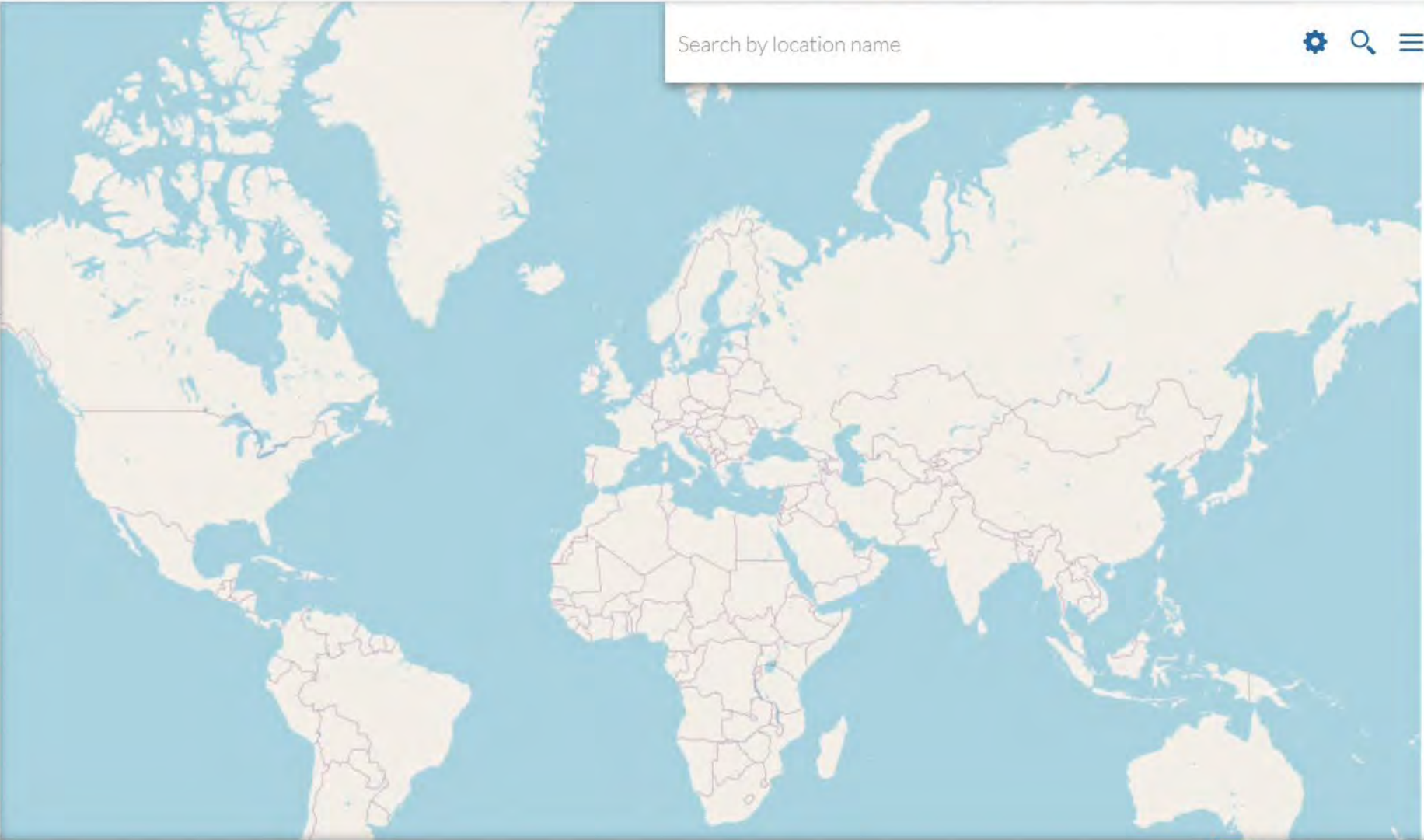
Transboundary Aqi...

2020 - Transboundar...

2015 - Transboundar...

2014 - Transboundar...

2012 - Transboundar...





Search by location name

Well and Monitoring Data

Lat: 38.468 - Long: -82.383

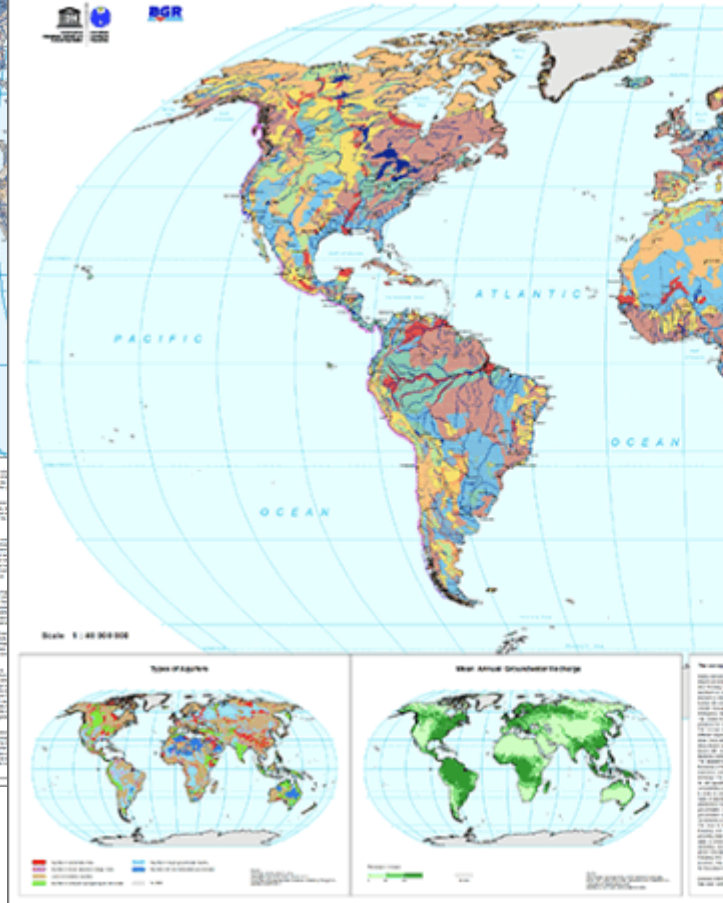
GGIS UID	U.S. Geological Survey (United States)-382205082304501
Name	Way-0144
Feature Type	Water well
Purpose	Observation / monitoring
Status	Active
Organisation	U.S. Geological Survey (United States)
Country	United States
Construction year	
Aquifer Name	
Aquifer Type	
Manager	

World Karst Aquifer Map

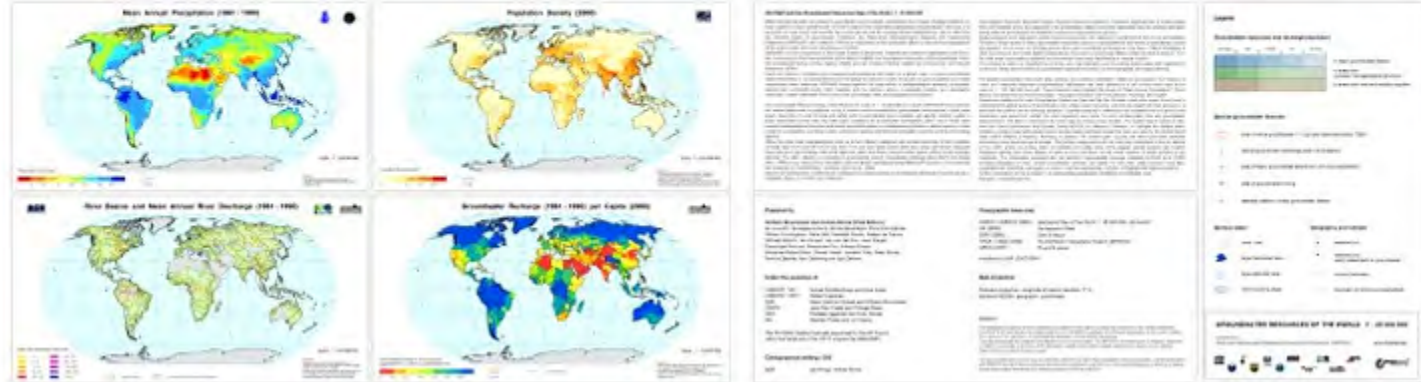
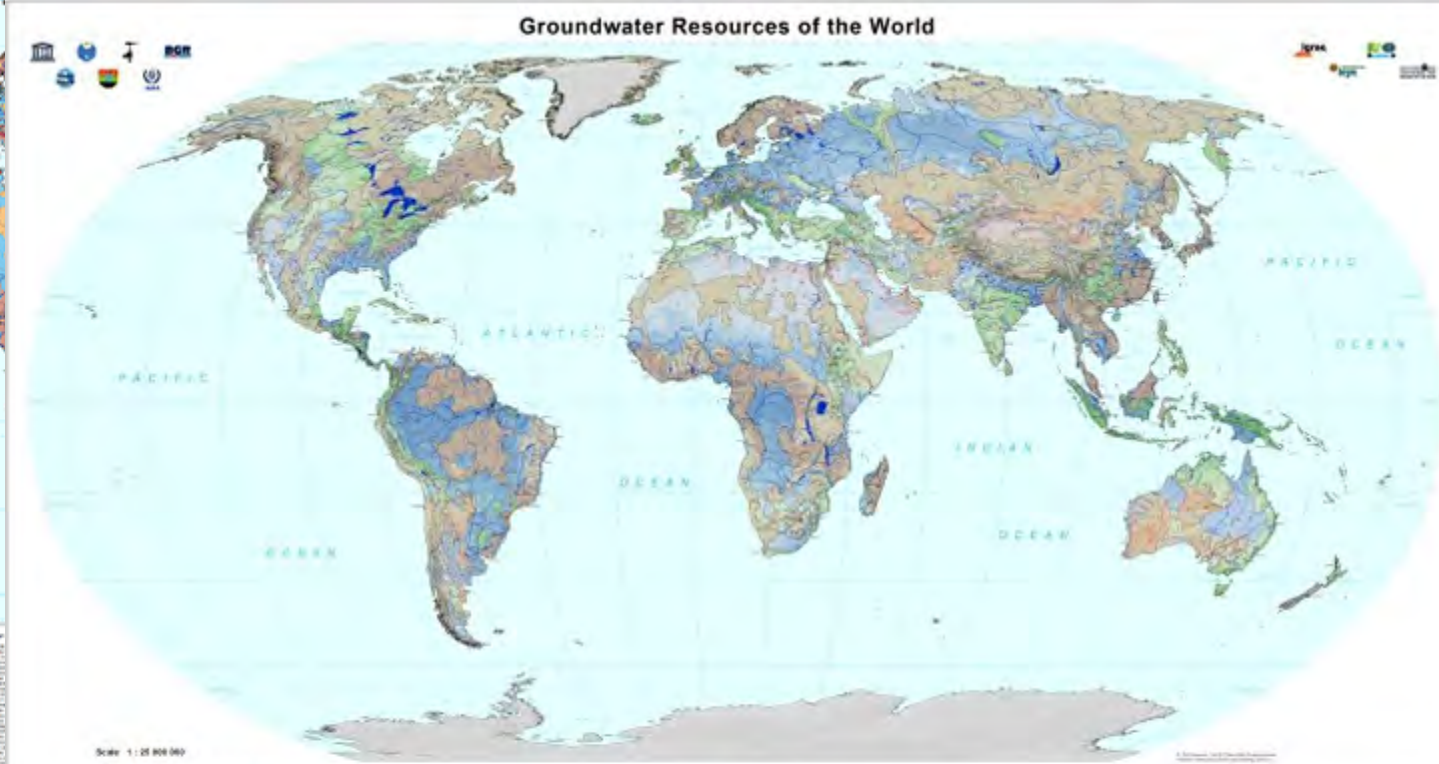


BGR & UNESCO Groundwater Resources

Global Groundwater Vulnerability to Floods and Droughts



Groundwater Resources of the World



Groundwater Assessment Platform

ACTIVE LAYERS

GAP layers

- GAP GROUNDWATER QUALITY P...
- GROUNDWATER QUALITY MEAS...










Geology, Climate, Populat...


- CLIMATE
- GEOLOGY - AGE
- GEOLOGY - LITHOLOGY
- SOCIOECONOMIC
- SOIL
- TOPOGRAPHY

Groundwater Assessment Platform

GAP Maps allows you to view and print maps related to geogenic groundwater contamination. By creating a [free login](#), you can also upload your own data to view, share or model. By default, your data are private, however you can choose to share them with individual users, with a community of users or publicly. You can also grid your point data or model them using logistic regression to produce a prediction map.

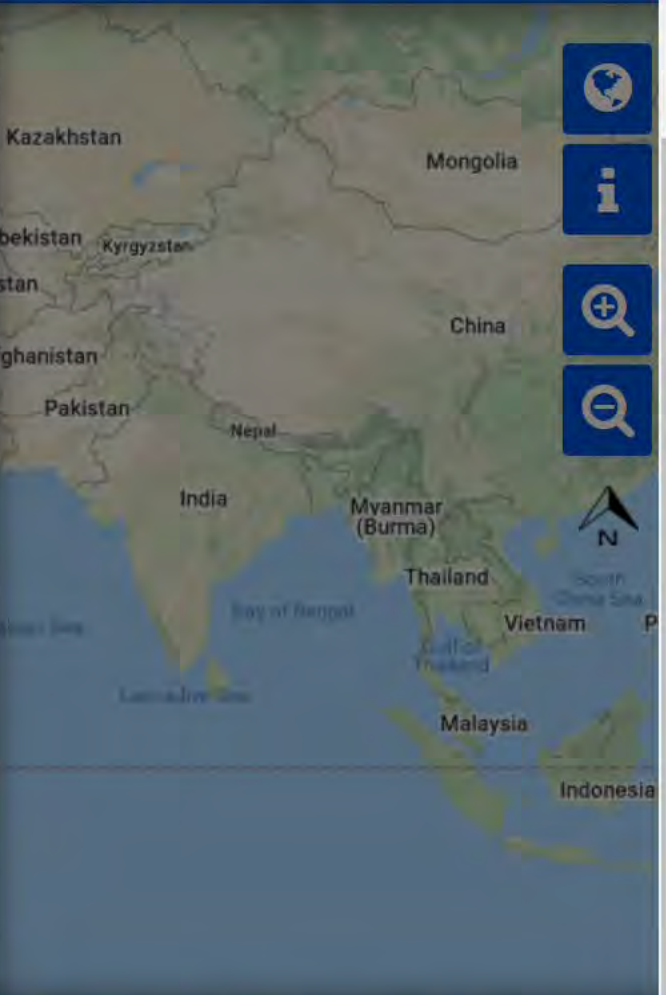
Use the buttons on the left and right sides of the screen to access and navigate GAP's maps and functionality:

 Layer list - active and available layers	Select a base map 
 My Layers* - upload and manage layers	Get data at a point 
 Statistical Analysis* - grid or model your data	Zoom in or out (or use mouse wheel)  
 Community* - interact with groups of users	
 Print - print a PDF map	* Available only when logged in

Go to the [Help](#) to learn how to use a particular section by clicking the question mark  or by using the Help link in the top bar.

[Close](#) [Never show again](#)

WATER GIS | [Contact](#) | [Register](#) | [Log in](#)



Map showing regions: Kazakhstan, Mongolia, Pakistan, India, Myanmar (Burma), Thailand, Vietnam, Malaysia, Indonesia.

Groundwater Level Mapping Tool

Home

Regional Map

Select Region

Texas

Select Aquifer

Select Data Type

Depth to Groundwater

Available Raster Animations

Minimum Samples per Well

5

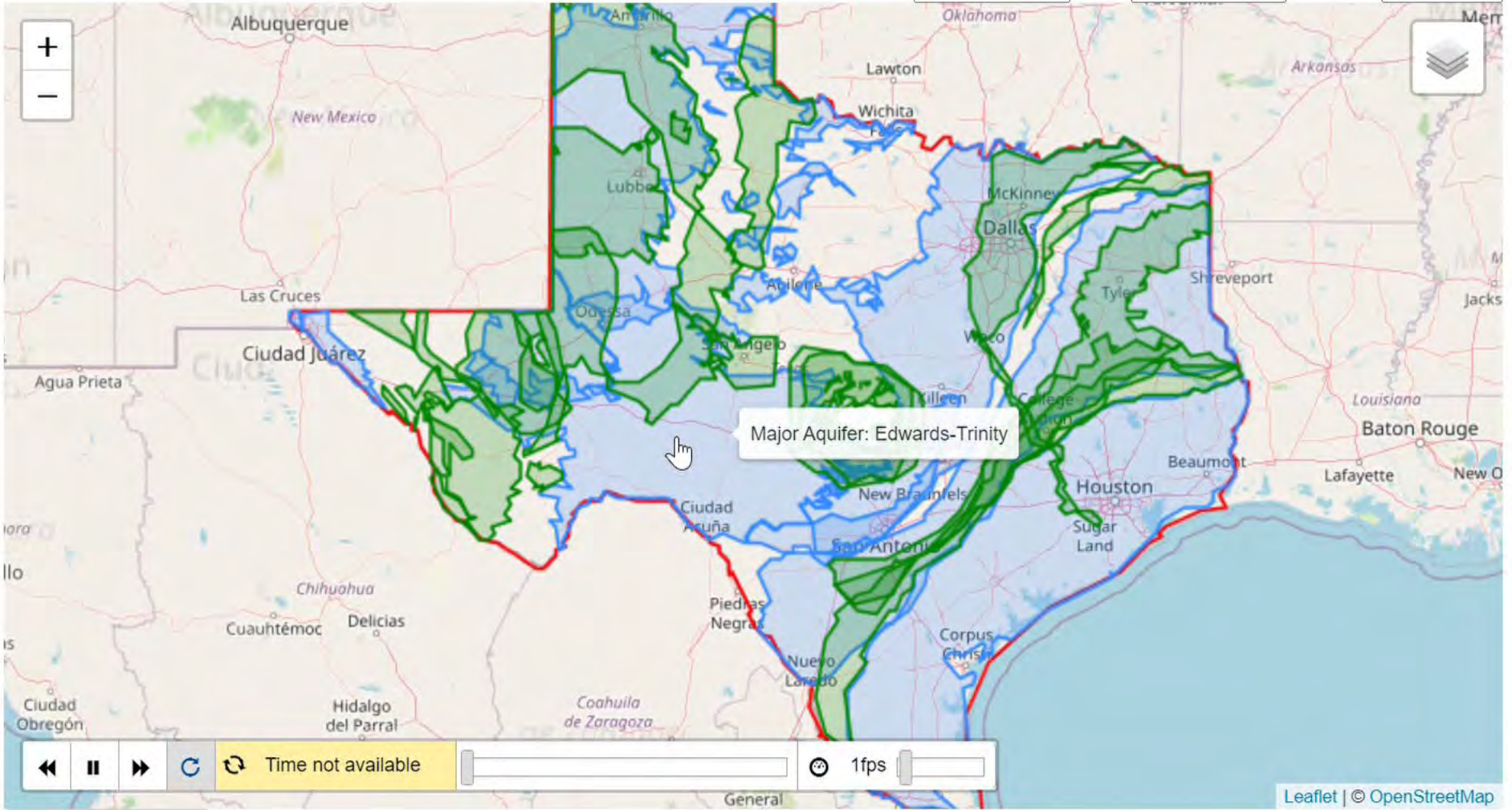
Map Height: 500 pixels

Select Symbology: GRACE

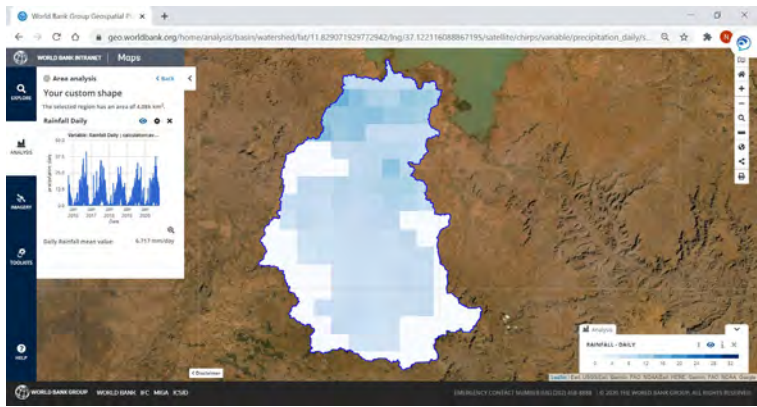
Min: -500

Max: 0

Opacity: 0.7

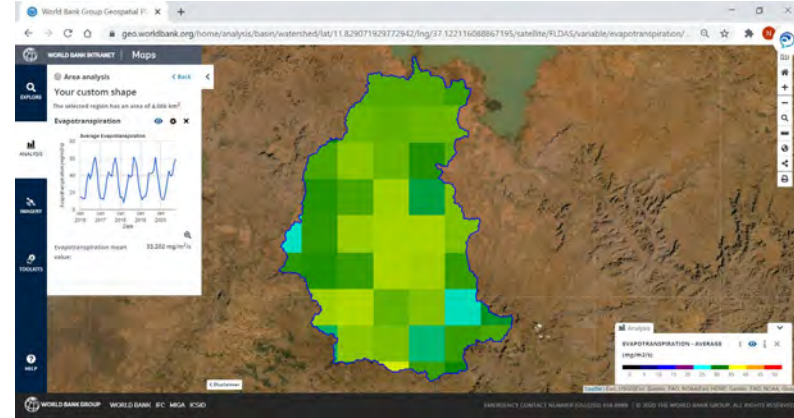


Region Home



Precipitation

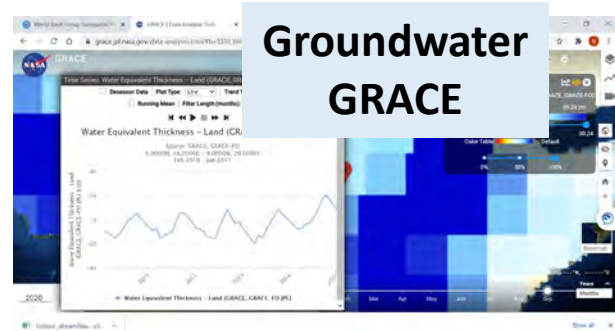
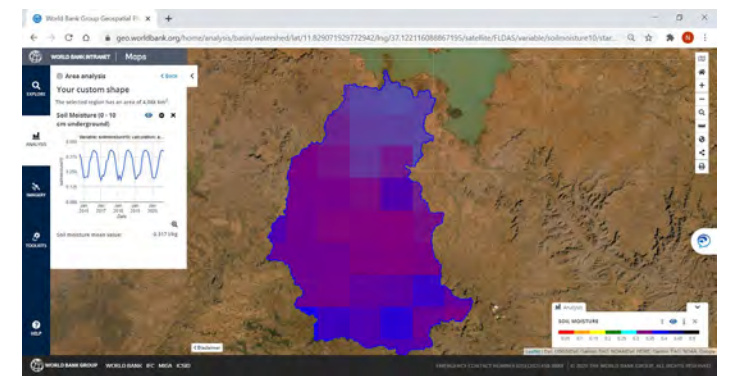
Evapotranspiration



Streamflow

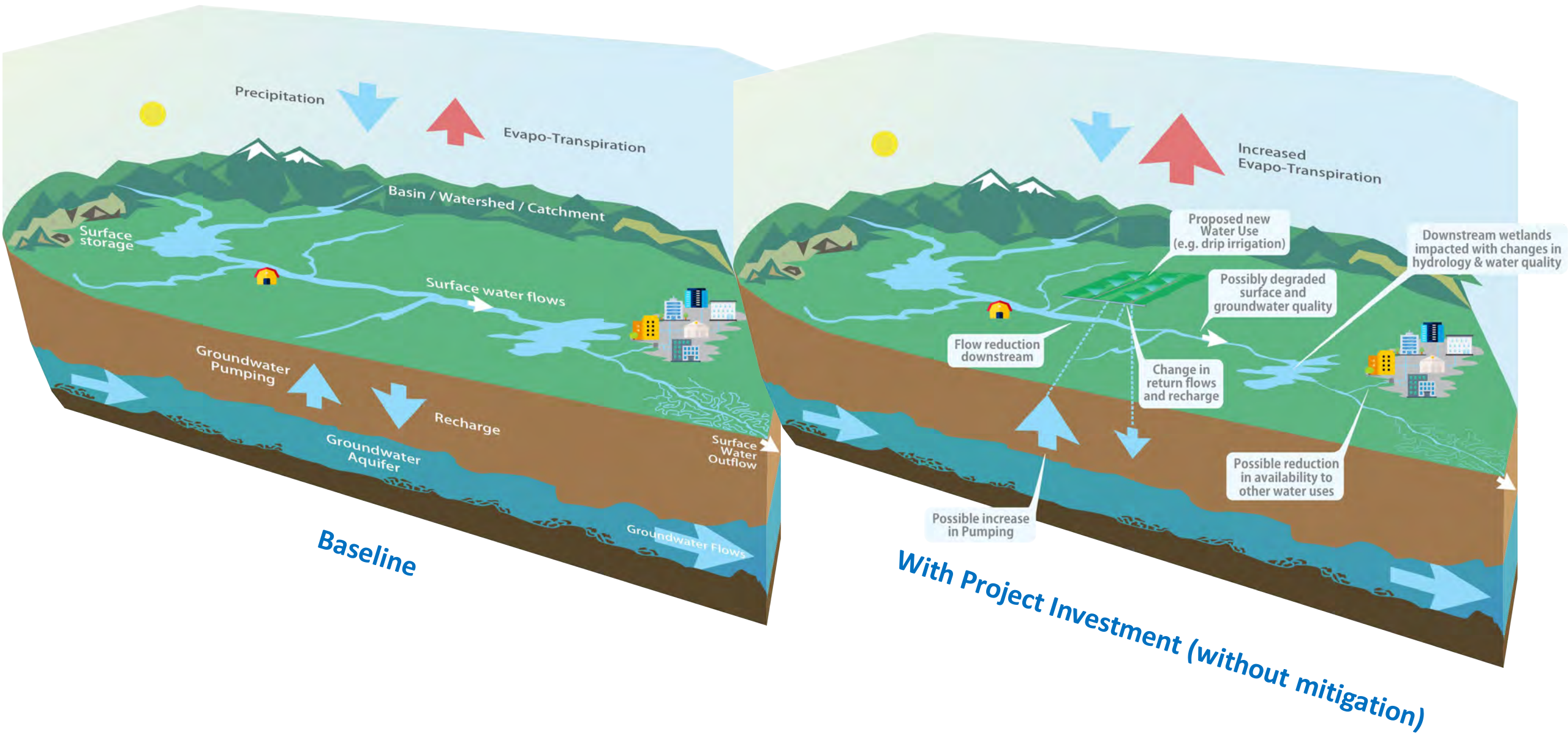


Soil Moisture



Groundwater GRACE

Water Use & Balance in a Systems Context



Watersheds, Topography

Water basin analysis < Back

Watershed generator

Click on stream on map to delineate its watershed



< Disclaimer

Leaflet | Esri, USGS, Esri, Garmin, FAO, NOAA, Esri, HERE, Garmin, FAO, NOAA

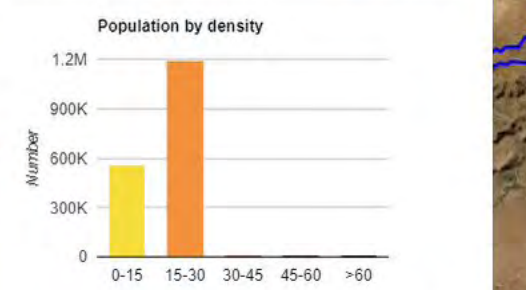
Population

Area analysis [Back](#)

Your custom shape

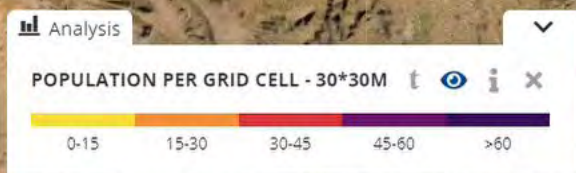
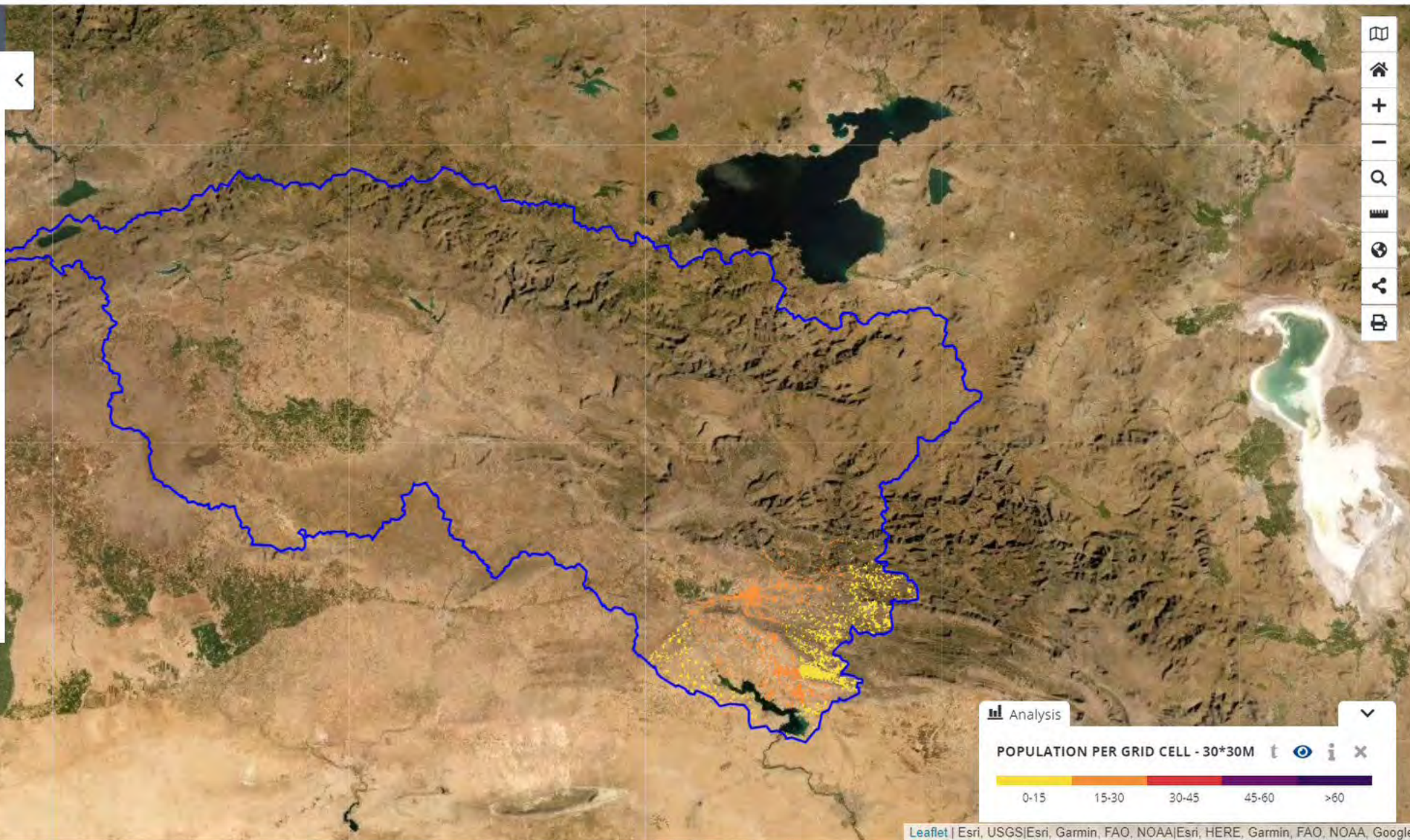
The selected region has an area of 50.89k km².

Population [View](#) [Settings](#) [Close](#)



Total Population in 2018 : 1.744 m

Population Density in 2018: 34.274 per km²



[Disclaimer](#)

Population Trends

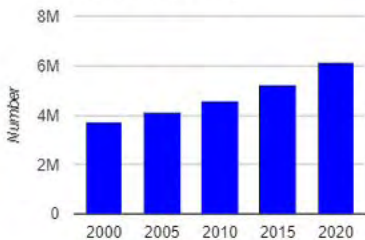
Area analysis

Your custom shape

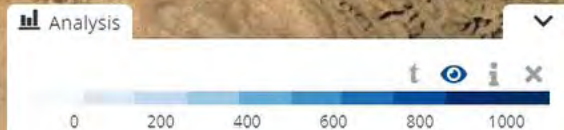
The selected region has an area of 50.89k km².

Population

Population by density



Total Population in 2000: 3.723m people
Population Density in 2000: 73.158 per km²



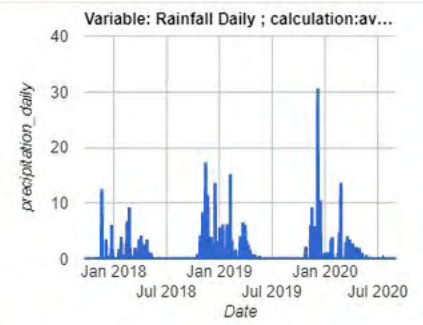
Rainfall

Area analysis

Your custom shape

The selected region has an area of 2.93k km².

Rainfall Daily



Daily Rainfall mean value: 1.829 mm/day

< Disclaimer



Vegetation (NDVI)

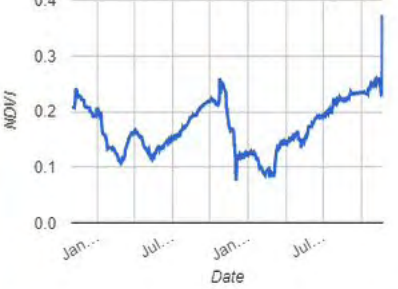
Area analysis

Your custom shape

The selected region has an area of 2.93k km².

NDVI

Variable: NDVI; calculation: average



Vegetation Health mean value: 0.173



Disclaimer

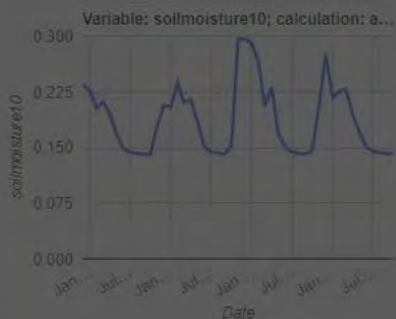
Soil Moisture

Area analysis

Your custom shape

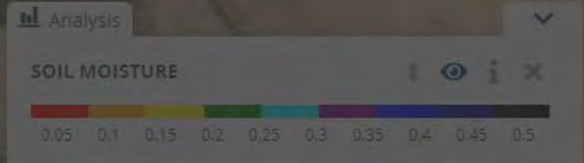
The selected region has an area of 2.93k km².

Soil Moisture (0 - 10 cm underground)



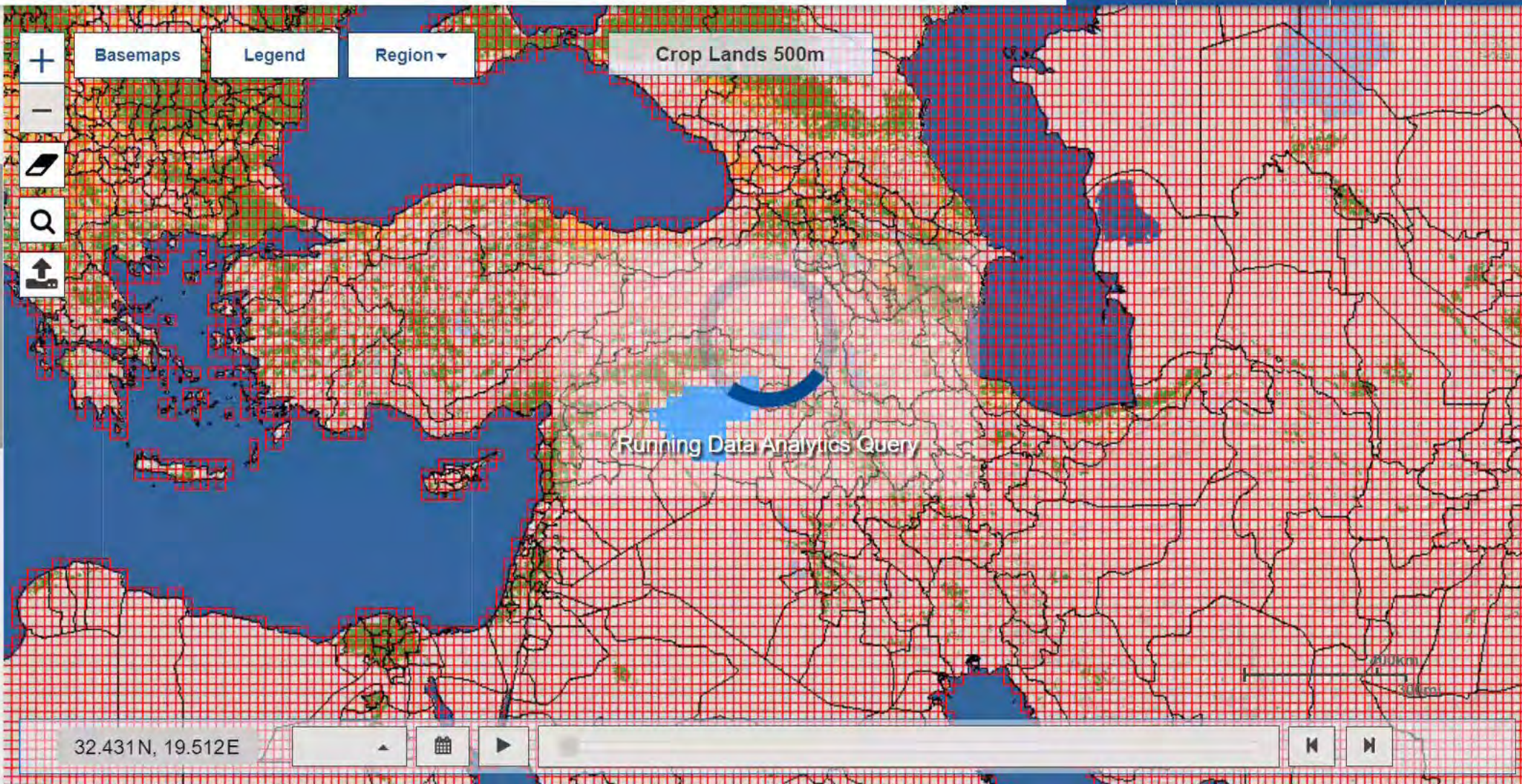
Soil moisture mean value: 0.188 l/kg

Performing Analysis...



Sub-surface Soil Moisture

7. Select Time Interval
Jan to Dec
5. Select Years
2017,2018,2019,2020
6. Select Chart Type
Line Chart
7. Select Selection Type
Draw Area Admin Units
8. Draw Area
Admin Type State or Province
Run Analytics
Reset



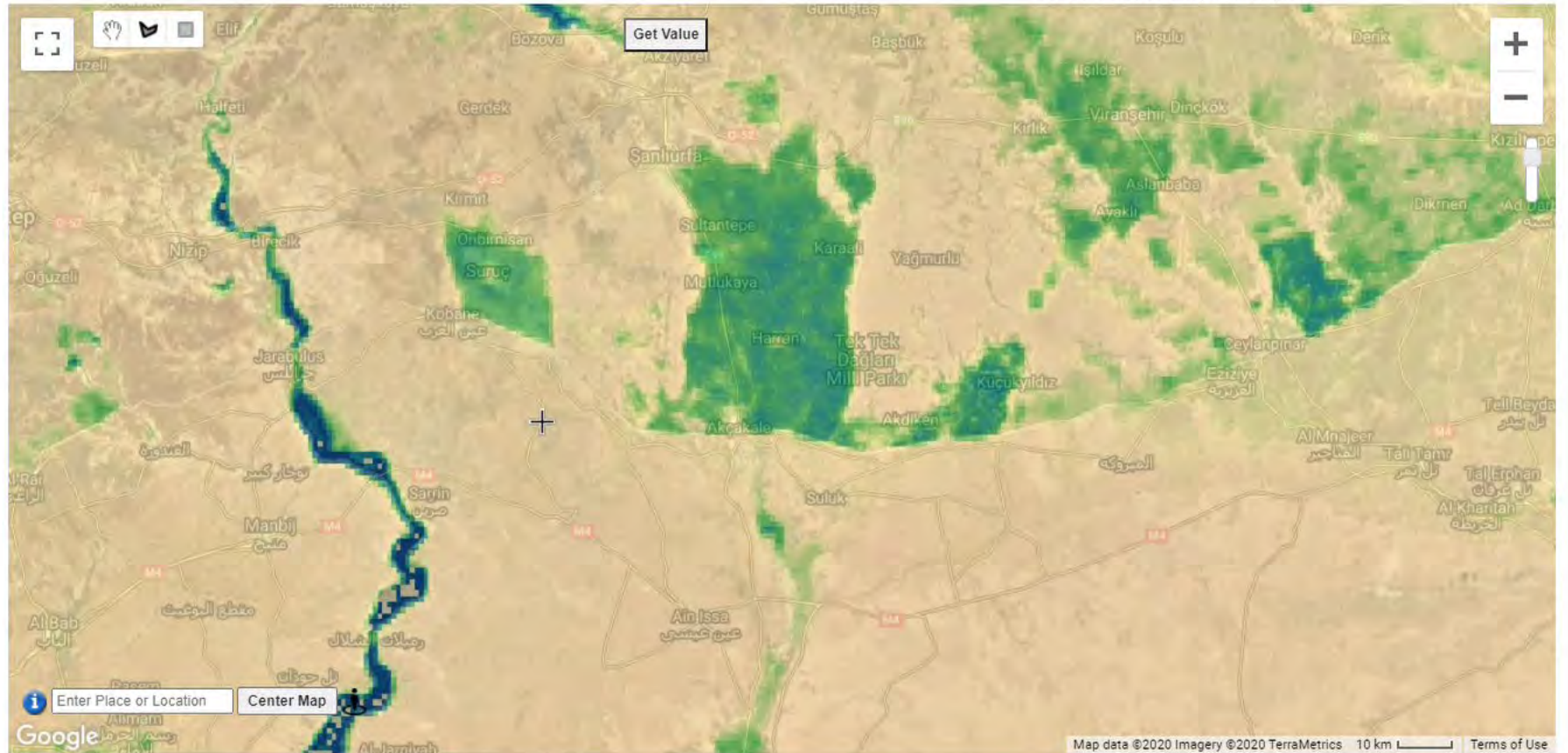
Evapo-Transpiration

MENU Map

2019-11-02 to 2020-11-01, Total

0.0 500 1,000 1,500

Actual Evapotranspiration (mm)



Make Map Make Graph

GET TIME SERIES

Time Series Calculation: ?

Native Time Series

One Variable Analysis

Region: ?

Polygon

Add another region

Variable 1

Variable 1 ?

Type: Remote Sensing

Dataset: USGS MODIS ET - SSEBop Dekadal

Variable: Evapotranspiration (ETa)
Units: millimeters

Computation


Resolution (Scale): 1000 m (1/96-deg)

Statistics (over region):

Evapo-Transpiration


Region: 
 Polygon 


MENU



 Add another region

Variable 1

Variable 1 
Type: Remote Sensing

Dataset: 
USGS MODIS ET - SSEBop Dekadal

Variable: 
Evapotranspiration (ETa)
Units: millimeters

Computation
Resolution (Scale): 
1000 m (1/96-deg)
Statistic (over region): 
Mean

Time Period 
Period of Record: 2003-01-01 to 2020-11-01
Entire Period of Record of Dataset

Start Date: 2003-01-01
End Date: 2020-11-01

 GET TIME SERIES

Graph

Link



Processing Request

This computation requires a large amount of daily data and may take a couple of minutes.



Layers



THEME

Land Cover Classification (Bekaa, Lebanon - Dekad

DEKAD (10-DAYS PERIOD)

20/12/2019



WaPOR 2.1

My WaPOR Info Feedback

LEGEND

Land Cover Classification (Bekaa, Lebanon

- Tree cover (dense)
- Grassland
- Bare
- Wetland
- Artificial
- Fallow
- Wheat
- Irrigated wheat
- Maize
- Irrigated maize

More options



ANALYSIS



LOCATE

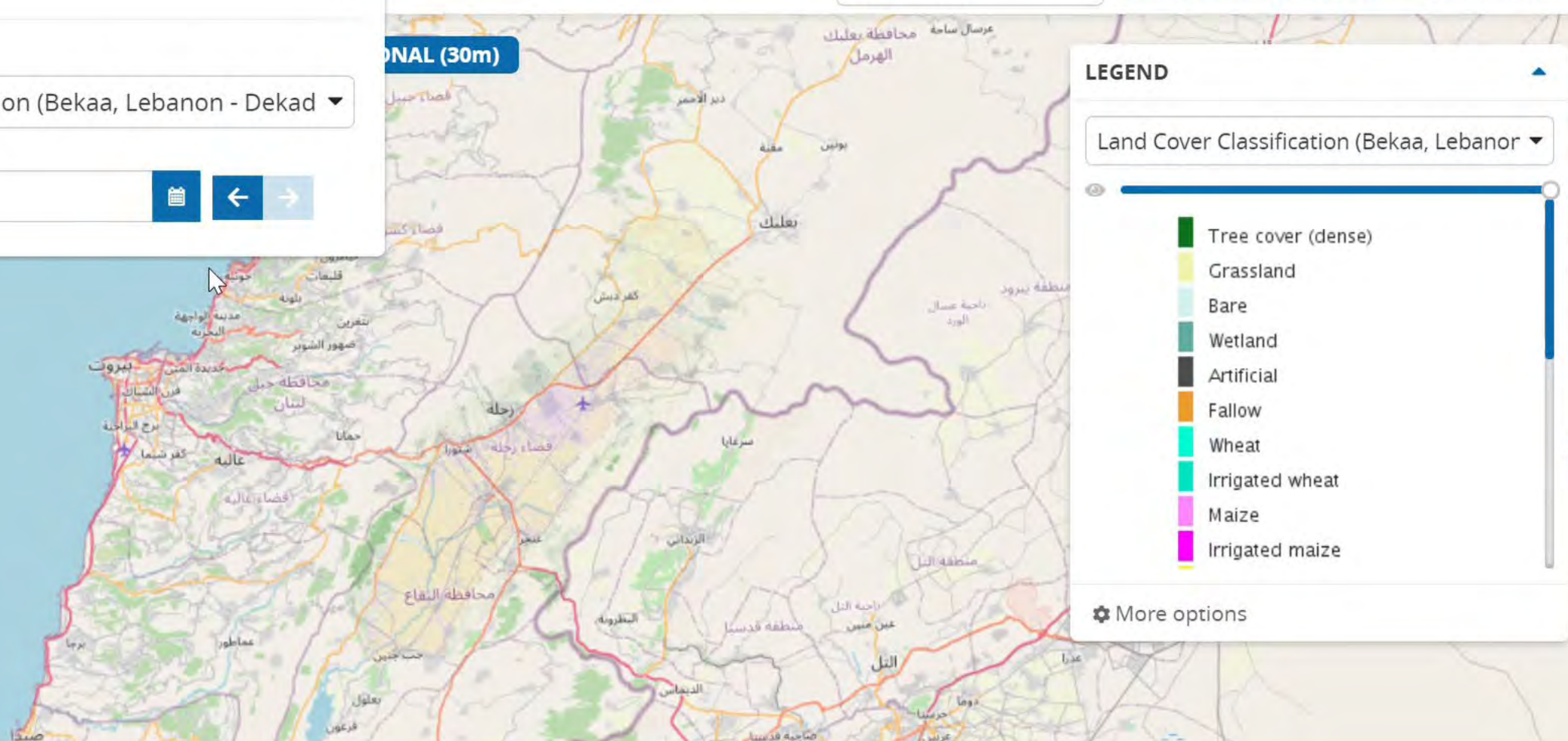


LAYERS

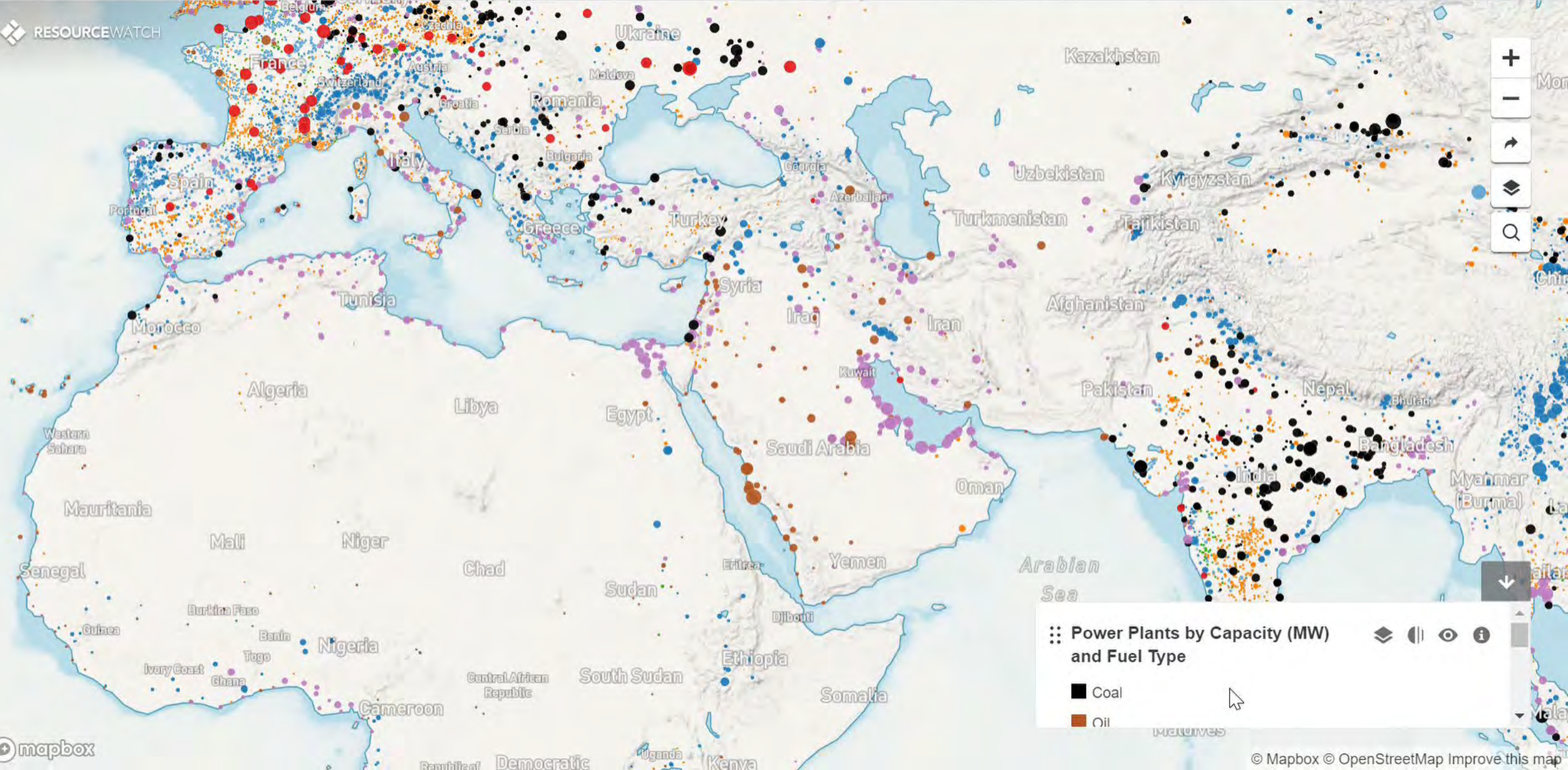


CATALOG

10 km



Power Plants

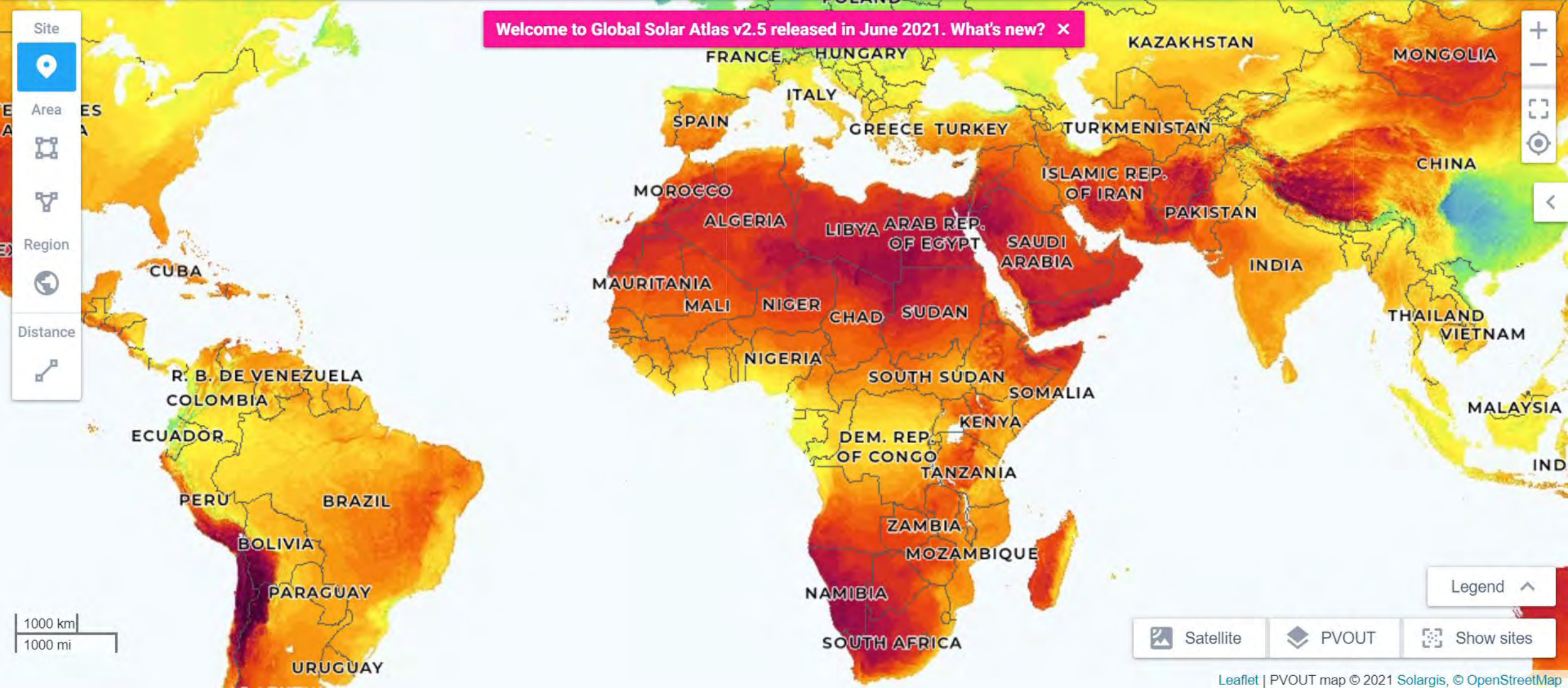


Power Plants by Capacity (MW) and Fuel Type

- Coal
- Oil

Solar Potential

Welcome to Global Solar Atlas v2.5 released in June 2021. What's new? X



Site

Area

Region

Distance

Map navigation controls: zoom in (+), zoom out (-), full screen, location, back

1000 km
1000 mi

Legend ^

Satellite PVOUT Show sites

Digital Infrastructure ([World Bank Infrastructure Toolkit](#))

THE WORLD BANK | **Maps**
IBRD · IDA

GLOBAL | REGIONAL | NATIONAL

Infrastructure < Back

Geographic Context

Digital

Digital Networks

- Internet Exchange Points
- Submarine cables

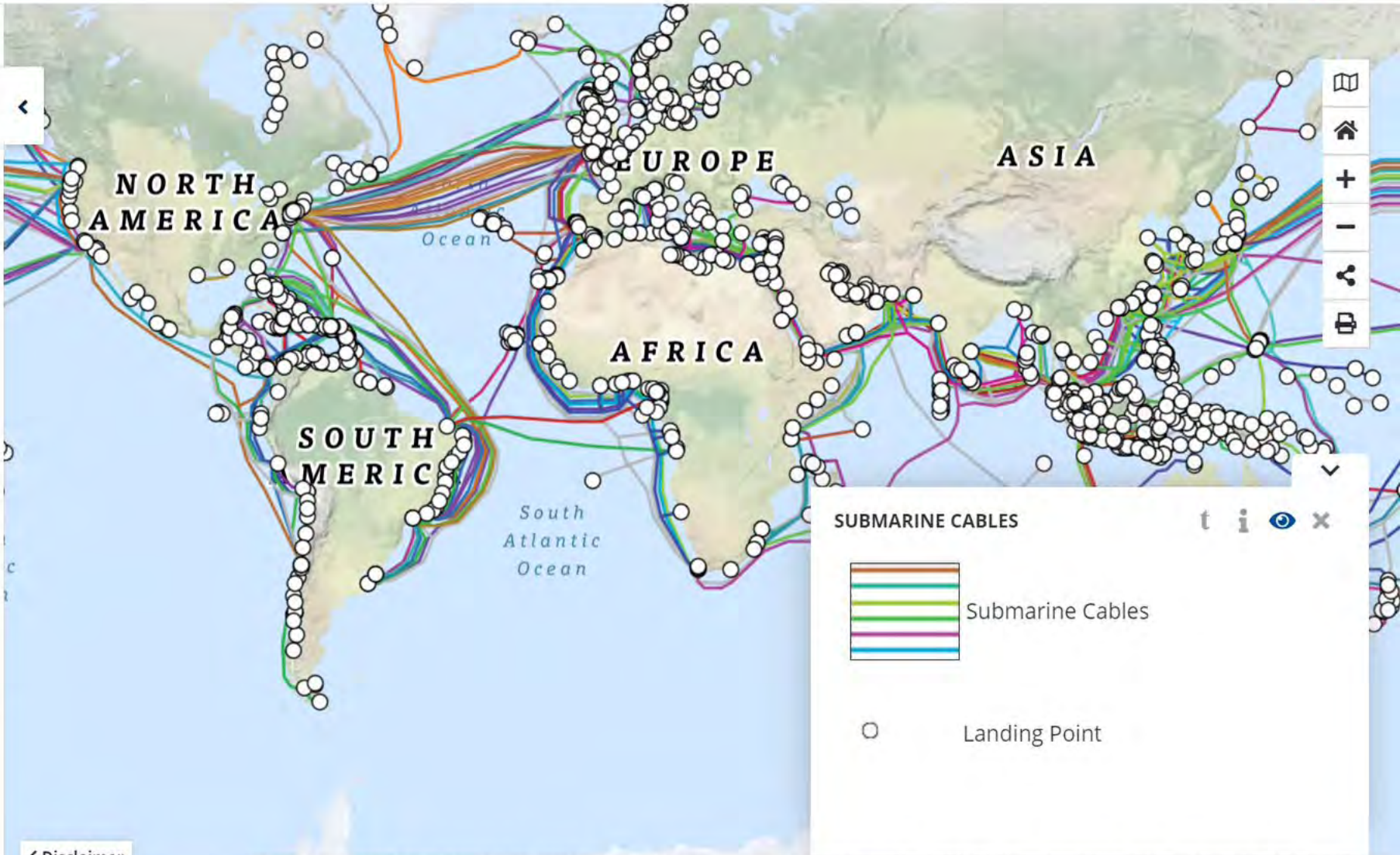
Digital Services

Demand

- Fixed broadband subscriptions (per 100 people)
- Mobile cellular subscriptions (per 100 people)

Energy

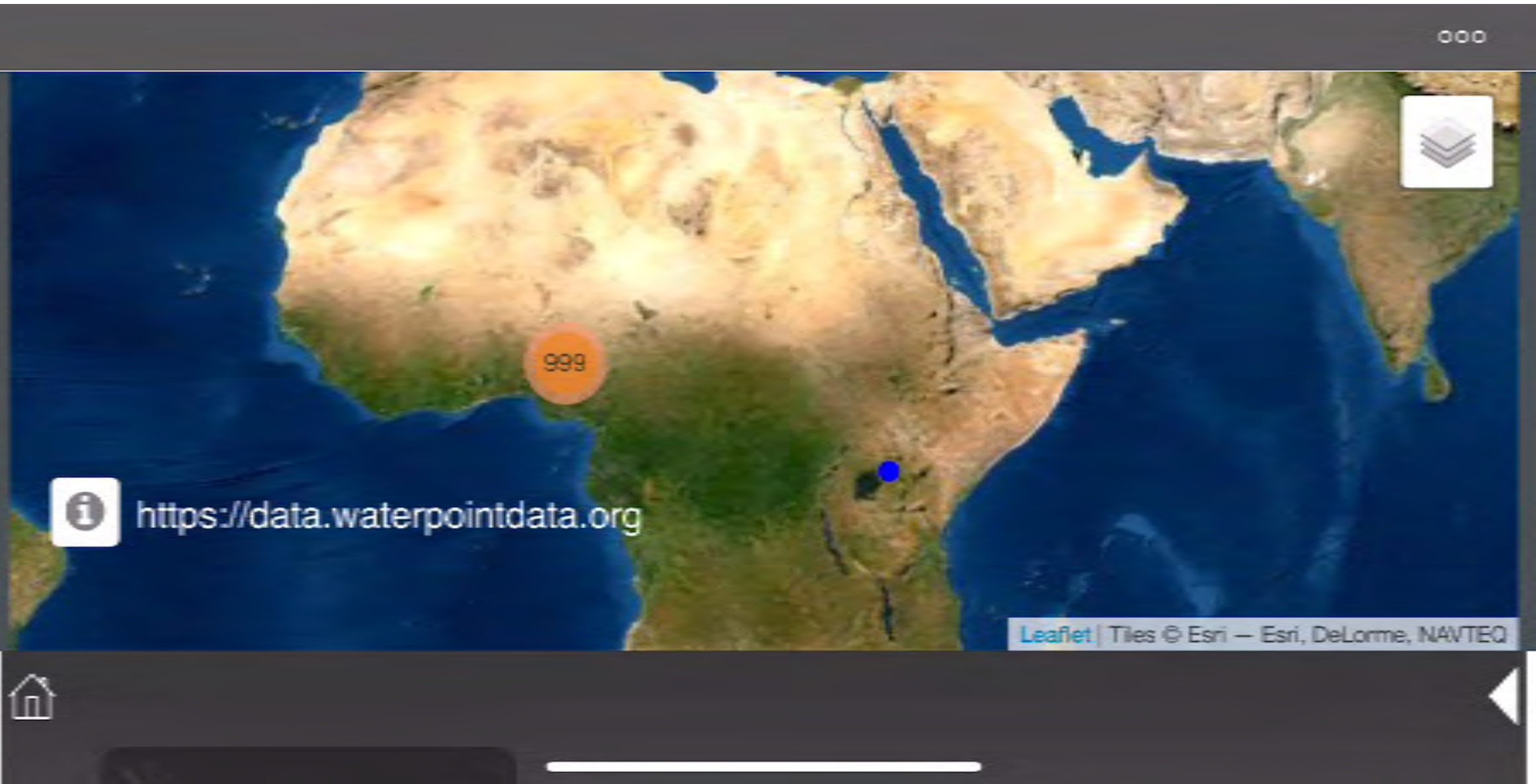
Transport



< Disclaimer

Data from Water Point Data Exchange in Spatial Agent Mobile App

<https://data.waterpointdata.org/>



Public Data e.g. MASDAP: <http://www.masdap.mw/>

Welcome! - www.masdap.mw

← → ↻ 🏠 ⚠ Not secure | masdap.mw

— 📄 ✕
☆ ⚙️ N ⋮



Data ▾ Maps About ▾

🔍 Search

Sign in

Malawi Spatial Data Platform

A public platform for GIS Data
to support development in Malawi

Get Started »

Search for Malawi Data.



OGC WaterML 2: Part 4 – GroundWaterML 2 (GWML2)

- 1) Overview
- 2) Downloads
- 3) Official Schemas
- 4) Related News

1) Overview

This standard describes a conceptual and logical model for the exchange of groundwater data, as well as a GML/XML encoding with examples.

2) Downloads

Version	Document Title (click to download)	Document #	Type
2.2.1	OGC WaterML 2: Part 4 – GroundWaterML 2 (GWML2)	16-032r3	IS

OGC Standards

- 3D Tiles
- 3dP
- ARML2.0
- Cat: ebRIM App Profile: Earth Observation Products
- Catalogue Service
- CDB
- CityGML
- Coordinate Transformation
- EO-GeoJSON
- Filter Encoding
- GML in JPEG 2000
- GeoAPI
- GeoPackage
- GeoSciML
- GeoSPARQL
- Geography Markup Language

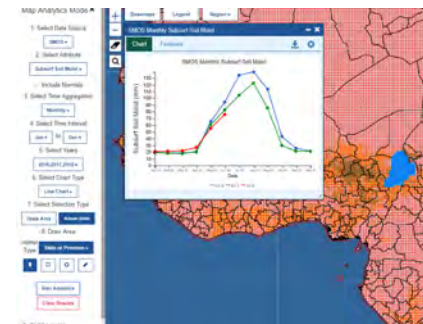
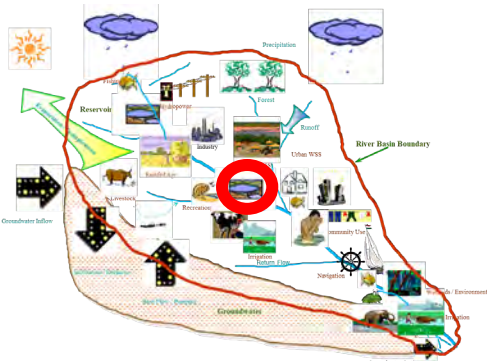
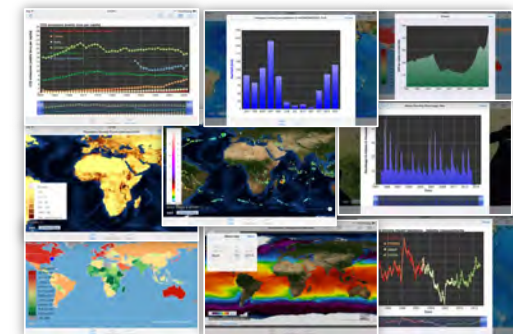
OGC: <https://www.ogc.org/>

Also see: <https://link.springer.com/article/10.1007/s10040-018-1747-9>

Illustrative Interactive Dashboards

Example for Water Infrastructure Operations

Decisions to be Supported: **When to release? How much to release?**



Climate

- Rainfall in upstream watershed (GPM, in-situ gauges/radar, CHIRPS, ...) – current & historical
- Weather forecasts (short-term, seasonal); Storm tracks
- Snowmelt estimates (if relevant)...

Flows

- Current and historical flows (from in-situ observations, satellite estimates where possible)
- Dam inflow forecasts (e.g. from GEOGLOWS Global Streamflow Forecasting, local forecasts)...

System Levels

- Current and historical levels of this dam's reservoir as well as other storages in system (e.g. from satellite, in-situ gauges)...

Downstream

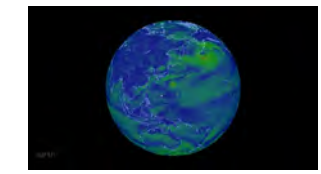
- Irrigation status (crops, crop stage from earth observation and in-situ)
- Soil and sub-surface soil moisture, groundwater (from earth observation and in-situ)...

Other Data & Analytics

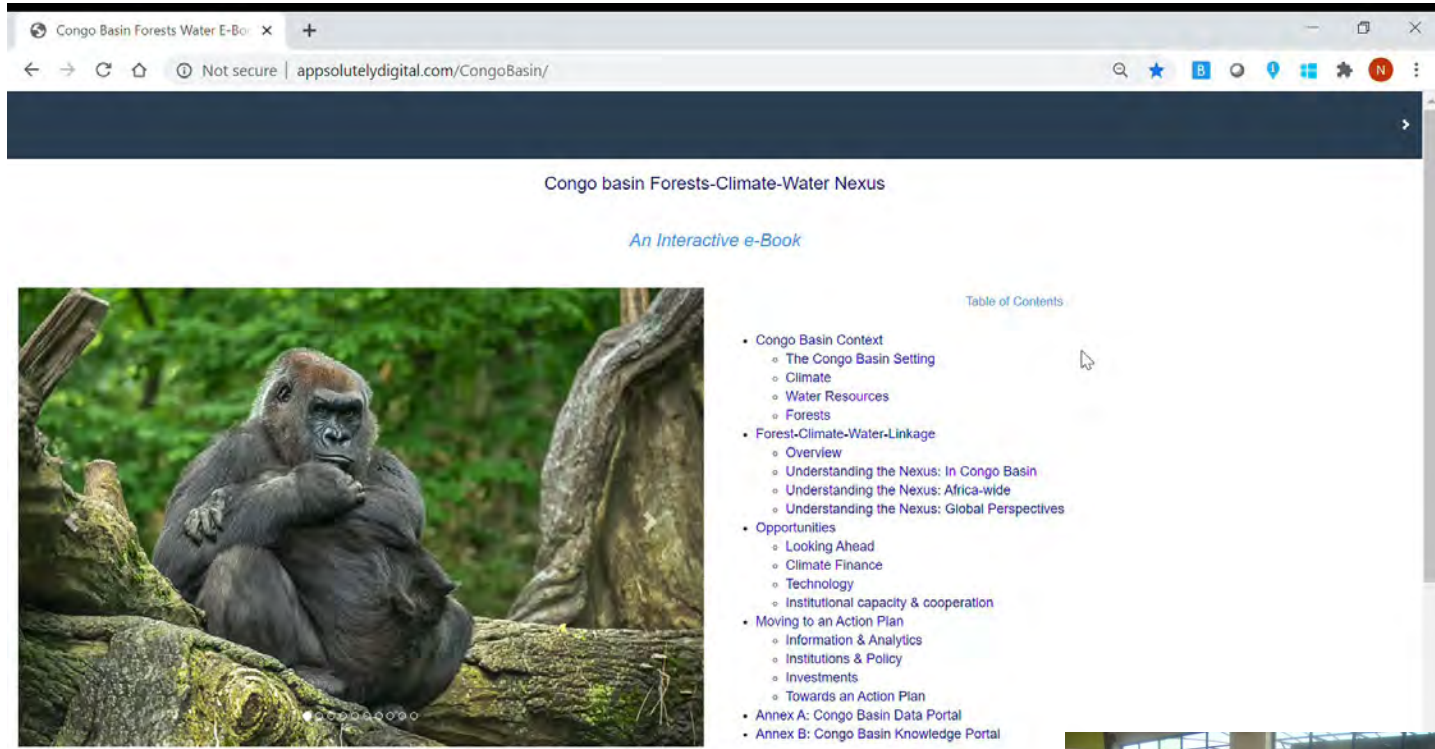
- Inundation forecasts
- Systems water infrastructure needs
- Systems model to explore implications of alternative dam operations
- Hi-resolution Satellite data
- Crowdsourced data



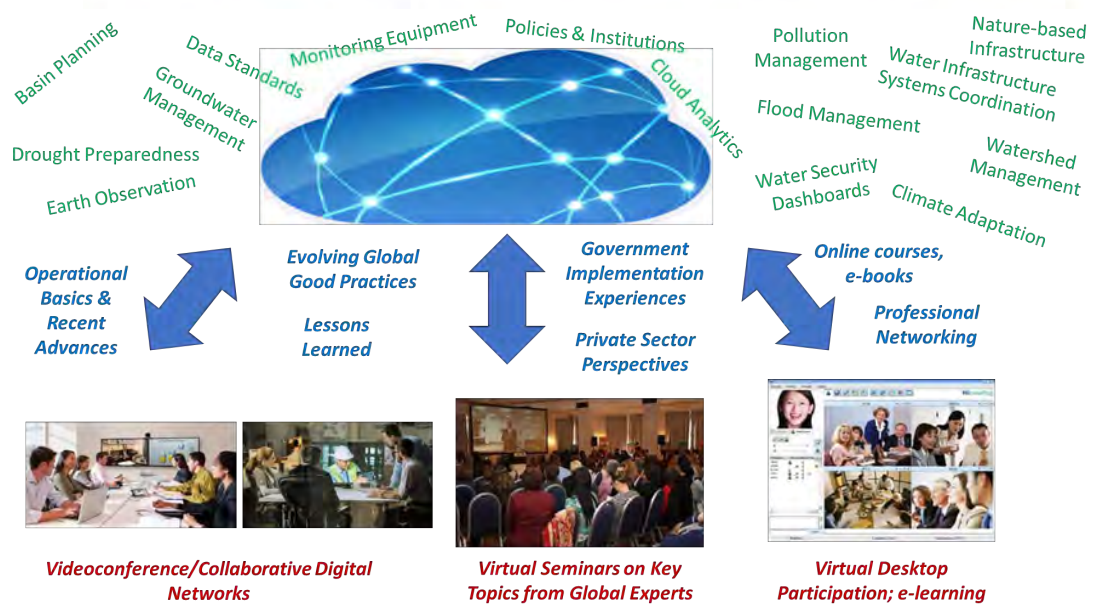
Need to draw upon global and other accessible data and analytic services to make interactive maps, graphs, and analytics for such decision support dashboards that are accessible on portals, apps, e-books, touchscreens, etc.



E-Packaging of Knowledge (e.g. Interactive E-books/ Storymaps)



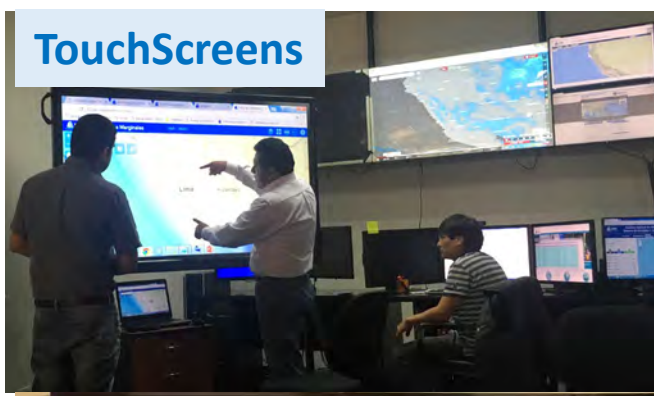
Outreach (e.g. virtual/online learning, hackathons, Expos)



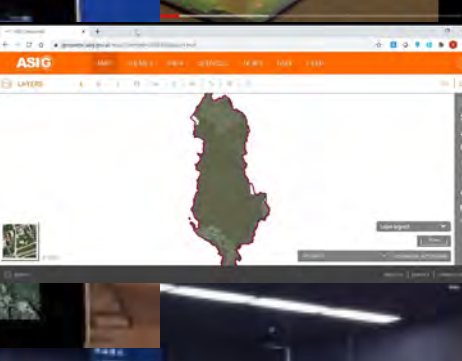
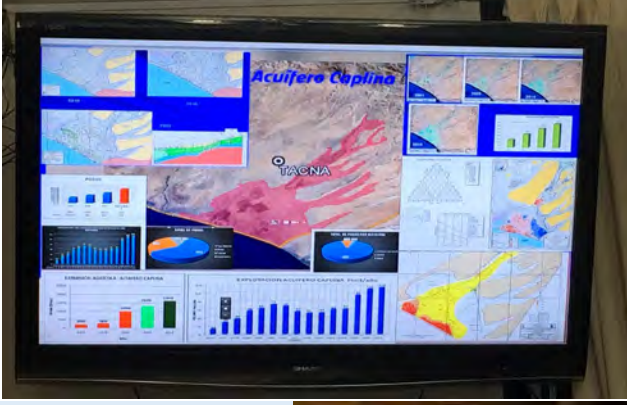
Large Displays



TouchScreens



Physical Interactive Models



Touch Tables



VR



Touch Projectors



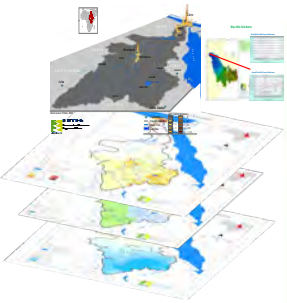
Reimagine Groundwater Management Challenges in a Disruptive Tech Context



Information

Understanding and monitoring groundwater systems (e.g. aquifers, extraction, recharge, quality)

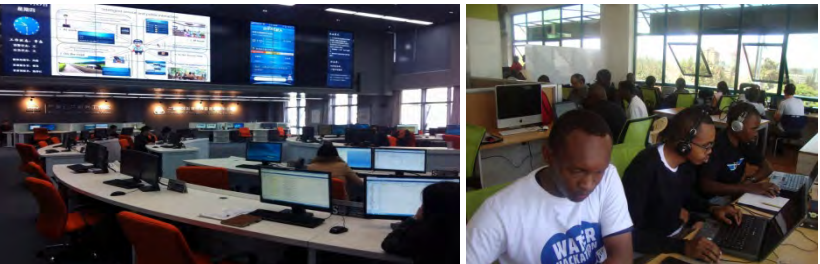
Analytic insights into specific groundwater links to water cycle and inform longer-term planning and shorter-term operational decision support



Institutions

Institutional arrangements to work across spatial and sectoral scales

Capacity, policies, and instruments to effectively manage groundwater effectively and sustainably



Investments

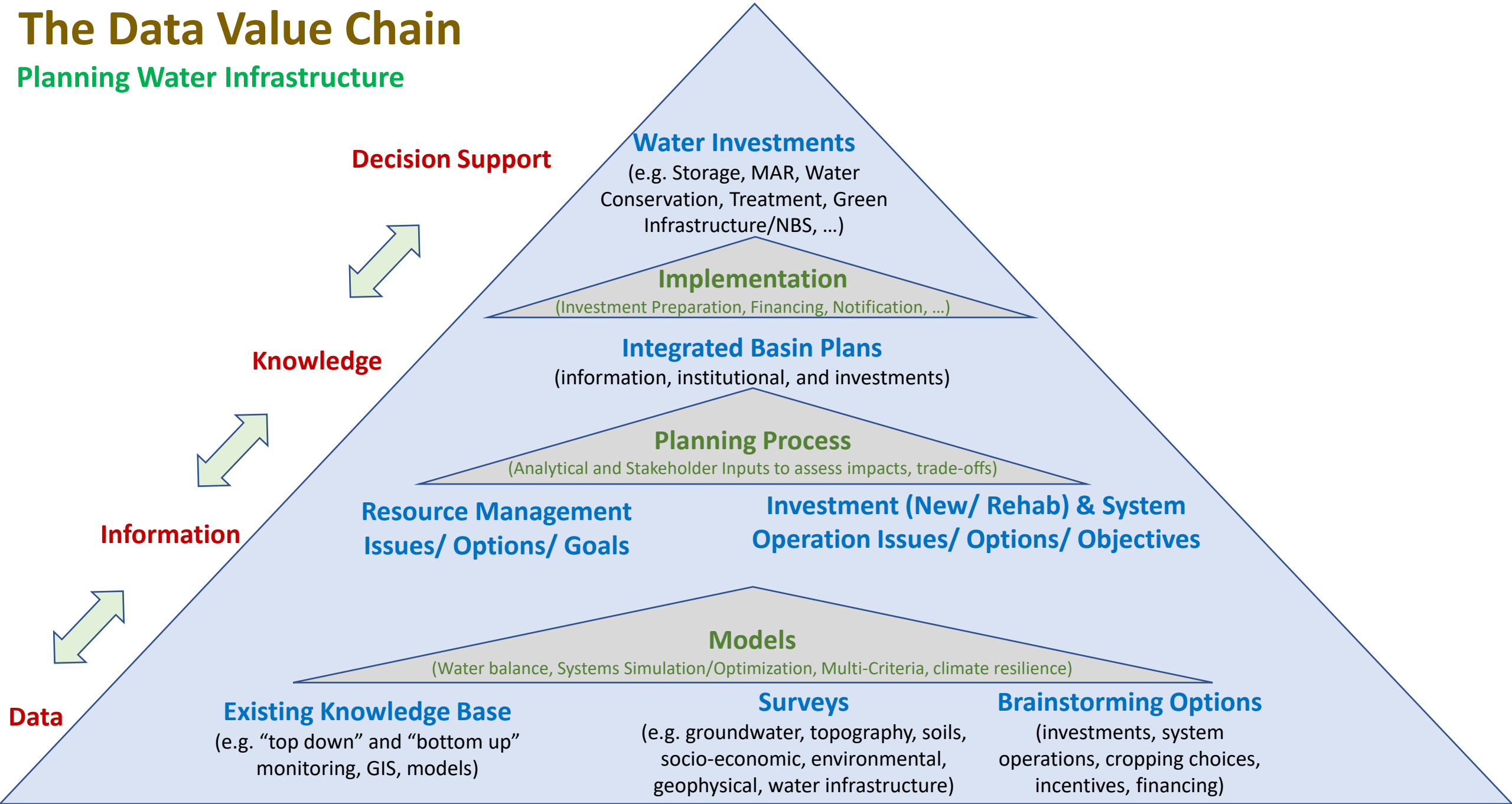
Planning and operation of extraction and recharge investments in a systems context

Development and climate scenario- based investment planning considering technical, environmental, social, economic, financial, institutional, and other sustainability aspects



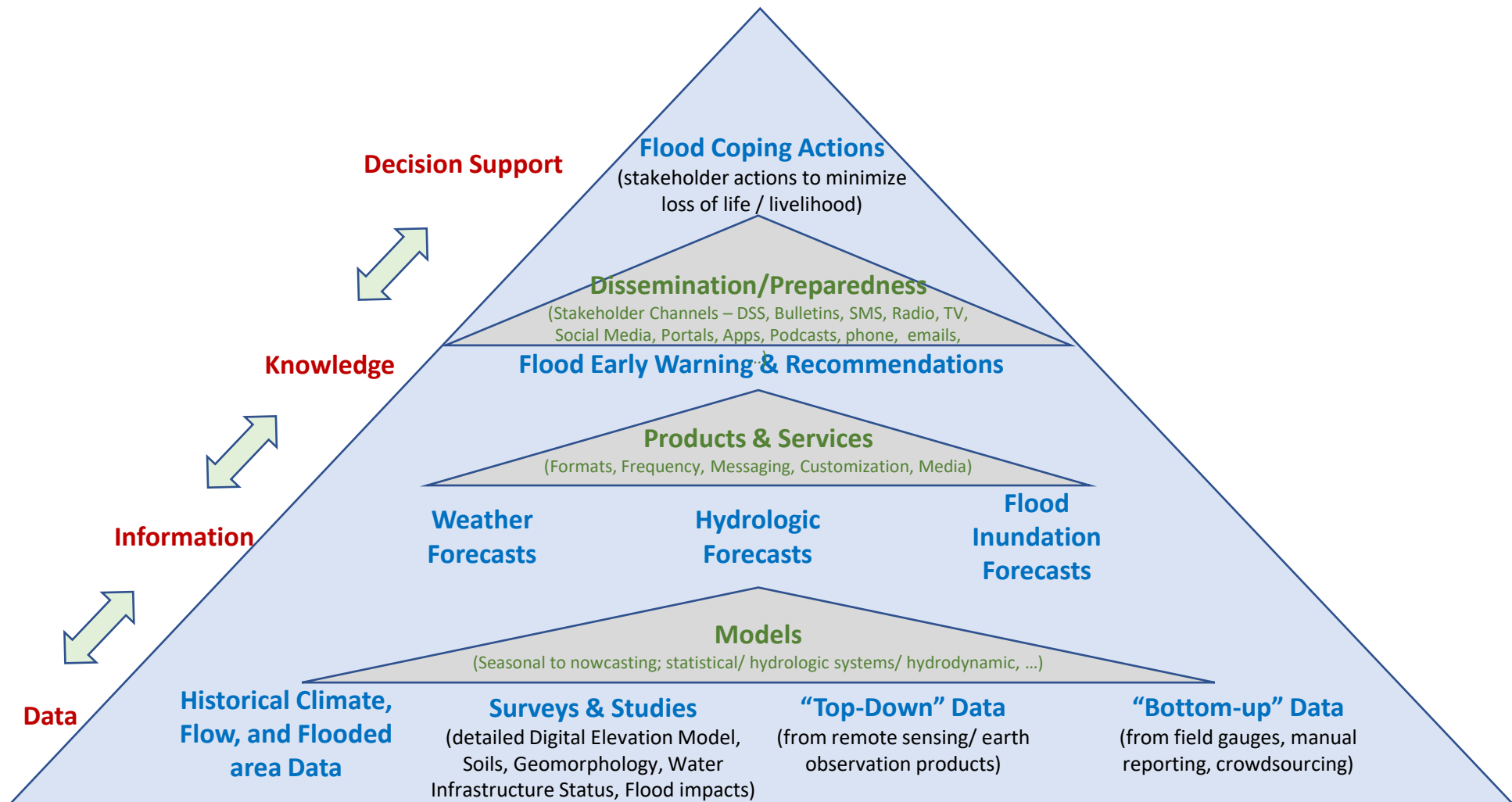
The Data Value Chain

Planning Water Infrastructure



The Data Value Chain

Example: Deciding on Coping with Floods



In Summary

- Please explore this growing Mashreq Water Data Portal Ecosystem:
 - [Mashreq Water Data Portal](#)
 - [Mashreq Water Knowledge Explorer](#)
 - [Disruptive Tech in Groundwater E-book](#)
- Please do showcase your data and analytics work!
- **Please** do contribute links to your **public-domain** data, models/scripts, analytics, case studies, knowledge products, videos that are in the public domain!



Disruptive Technology

WORLD BANK GROUP

Disruptive **KIDS** (Knowledge, Information & Data Services) Helpdesk

<http://spatialagent.org/KIDS/>



MC4 - 840



Disruptive Development
An Interactive Primer on Disruptive Technology in Development

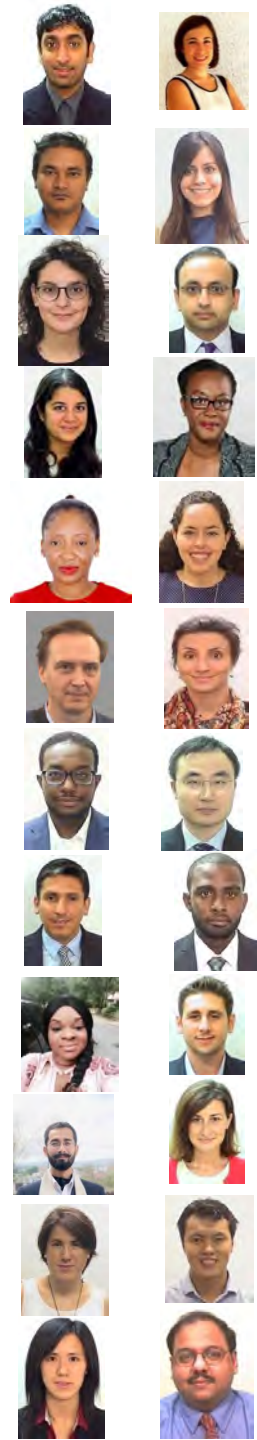
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ANALYSIS OF INTERNATIONAL FINANCING VISIBLE SPATIAL ANALYSIS TOOL

INTERACTIVE TECHNOLOGY APPLICATION EXPLORER

Use the following dropdown menu to explore a wealth of all data on technology access related to regional economic development. You can also download data on demand information on a geographical basis. Data is available from various sources, by the way, The Platform for Digital Development is being used to increase both readability in its work.



Disrupt or Be Disrupted!

Thanks!



<http://spatialagent.org/Mashreq/>

Nagaraja Rao Harshadeep (Harsh)
Global Lead (Disruptive Technology)
Environment, Natural Resources & Blue Economy Global Practice
The World Bank
1818 H St NW
Washington DC 20433
harsh@worldbank.org



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